Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
Amendment of Part 101 of the Commission's Rules to Facilitate the Use of Microwave for Wireless Backhaul and Other Uses and to Provide Additional Flexibility to Broadcast Auxiliary Service and Operational Fixed Microwave Licensees	)	WT Docket No. 10-153
Request for Interpretation of Section 101.141(a)(3) of the Commission's Rules Filed by Alcatel-Lucent, Inc., *et al.*	)	WT Docket No. 09-106
Petition for Declaratory Ruling Filed by Wireless Strategies, Inc.	)	WT Docket No. 07-121
Request for Temporary Waiver of Section 101.141(a)(3) of the Commission's Rules Filed by Fixed Wireless Communications Coalition	)	

NOTICE OF PROPOSED RULEMAKING AND NOTICE OF INQUIRY

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By the Commission: Chairman Genachowski and Commissioners Copps, McDowell, and Clyburn issuing separate statements.

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I. INTRODUCTION

1. In this *Notice of Proposed Rulemaking and Notice of Inquiry* (*NPRM/NOI*), we commence a proceeding to remove regulatory barriers to the use of spectrum for wireless backhaul and other point-to-point and point-to-multipoint communications. This proceeding will surface ways to increase efficient use of spectrum for backhaul, especially by updating regulatory classifications that may not have kept pace with the evolution of converged digital technologies. Providing for the more flexible use of microwave frequencies for backhaul may help promote access to backhaul solutions that are critical to the deployment of wireless broadband and other services. Our proposed rule changes may be particularly beneficial to rural areas, where wireline alternatives may not exist. Our proposed rules should increase opportunities for all users of point-to-point and point-to-multipoint services, while protecting established license holders who are already using these bands. As an initial matter, we believe 750 megahertz in the 13 gigahertz range and below can be made flexibly usable for broadband backhaul.

2. As noted in the 14th CMRS Competition Report, backhaul costs currently constitute a significant portion of a mobile wireless operator's network operating expense, and the demand for backhaul capacity is increasing.[1] Cost-efficient access to adequate backhaul thus will be a key factor in

[1] Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services, WT Docket No. 09-66, *Fourteenth Report*, FCC 10-81 (May 20, 2010) (*14th CMRS Competition Report*) at 160 ¶ 296.

promoting robust competition in the wireless marketplace. And while copper circuits currently serve as the predominant choice for backhaul, fixed wireless (including microwave) solutions are gaining popularity. Moreover, microwave may be the only practical high-capacity backhaul solution available to serve certain rural and remote locations.

3. By enabling more flexible and cost-effective microwave services, the Commission can help increase deployment of fourth-generation (4G) mobile broadband networks across America. Most wireless providers have announced planned upgrades to 4G technologies.[2] Several studies suggest that within the next five years, the amount of mobile data traffic in North America will increase by a factor of twenty to over forty times the level of data traffic in 2009.[3] As mobile data traffic increases, carriers will need to increase their backhaul capacity, including microwave backhaul, to accommodate that traffic. For example, AT&T has expressed concern that "[t]he amount of open spectrum . . . available for high capacity long distance links is quickly shrinking, particularly near major population centers."[4] We also anticipate that demand for microwave spectrum for other uses will increase.[5]

4. Consistent with the recommendations of the National Broadband Plan, this proceeding will explore ways to increase the flexibility, capacity, and cost-effectiveness of the microwave bands located below 13 GHz, while protecting incumbent licensees in these bands. We note that carriers are increasingly relying on wireless for their backhaul needs.[6] Current regulations designate different "silos" of microwave spectrum for different services. This proceeding proposes rule changes that will help integrate separate microwave spectrum designations into a larger pool that can be used for backhaul. By increasing the supply of available spectrum for wireless backhaul, we can help ensure that wireless backhaul will be a viable and cost-effective option for meeting increased demand for backhaul services. Furthermore, by reviewing our rules to determine whether it is appropriate to allow licensees to use adaptive modulation, technologies that allow greater reuse of spectrum, and smaller antennas, we work to ensure that licensees are allowed to provide wireless backhaul as efficiently and cost effectively as possible. Additionally, the proposed rule changes will benefit broadcasters and cable television providers through increased and more flexible access to microwave spectrum. Finally, more flexible rules should also facilitate networks that depend on microwave transmission to provide mission critical services, such as public safety, coordination of railroad train movements, control of natural gas and oil pipelines, and regulation of electric grids.[7]

II. SUMMARY

5. In this *NPRM/NOI*, we seek comment on several proposals. In the *Notice of Proposed Rulemaking* portion of this document, we offer specific proposals for increasing utilization of and providing increasing flexibility with respect to microwave spectrum. In the *Notice of Inquiry*, we ask more general questions and solicit other proposals for more cost-effective and intensive use of microwave spectrum. The proposals are:

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[2] *See* National Broadband Plan at Section 5.1 p. 77, Exhibit 5-B.

[3] *Id.*, at Section 5.1 pp. 76-77 and Exhibit 5-A.

[4] *See* Reply Comments of AT&T, Inc., RM-11417 (filed Apr. 30, 2008) at 2.

[5] *See* Reply Comments of Utilities Telecom Council, RM-11417 (filed Apr. 30, 2008) at 2 ("the need for data capacity across utility networks is accelerating quickly and is likely to continue for the next ten to twenty years.")

[6] In 2005, 8.7 percent of backhaul traffic was sent by fixed wireless. *See 14th CMRS Competition Report* at 160 ¶ 294. By 2009, that figure increased to 12.3 percent. *Id.*

[7] *See* Fixed Wireless Communications Coalition Petition for Rulemaking, RM-11417 (filed Feb. 4, 2008) at 4.

Notice of Proposed Rulemaking

- *Permitting Greater Sharing Between FS Operations in Certain BAS and CARS Frequencies*: We propose to allow Fixed Service (FS) operations to share certain spectrum bands currently used by the Broadcast Auxiliary Service (BAS) and the Cable TV Relay Service (CARS). We also propose to more fully accommodate broadcasters' spectrum needs by permitting greater access to spectrum by eliminating the "final link" rule that prohibits broadcasters from using FS stations as the final radiofrequency (RF) link in the chain of distribution of program material to broadcast stations.
- *Permitting Adaptive Modulation*: The Part 101 rules contain a minimum payload capacity rule intended to ensure that FS links are operated efficiently. We propose to allow temporary operations below the minimum capacity under certain circumstances, which will enable FS links – particularly long links in rural areas – to maintain critical communications during periods of fading.
- *Permitting "Auxiliary" Fixed Stations*: We seek comment on a proposal to permit greater reuse of scarce microwave resources, which may permit more efficient use of the spectrum at substantially reduced cost. Specifically, we seek comment on permitting FS licensees to coordinate and deploy multiple links – a primary link and "auxiliary" links.

Notice of Inquiry

- *Modification of Efficiency Standards in Rural Areas:* We seek comment on whether lowering the current efficiency standards in rural areas would lower costs associated with providing backhaul service.
- *Review of Part 101 Antenna Standards*: We seek comment on whether to review the antenna standards in any particular band to allow smaller antennas, to identify opportunities to facilitate increased deployment of FS facilities without subjecting other licensees to increased interference.
- *General Review of Rules.* We seek comment on whether we should examine any additional modifications to the Part 101 rules, or other policies or regulations, to promote flexible, efficient and cost-effective provisions of wireless backhaul service.

III. BACKGROUND

6. The Commission has licensed spectrum for microwave uses for most of its history.[8] In 1996, the Commission consolidated its rules for most microwave point-to-point and point-to-multipoint services into a new Part 101 of the Commission's Rules.[9] Part 101 includes the point-to-point Private Operational Fixed Service (POFS)[10] and the Common Carrier Operational Fixed Service.[11] The

[8] For an extensive discussion of issues the Commission faced in allotting microwave spectrum, *see* Allocation of Frequencies in the Bands Above 890 Mc., Docket No. 11866, *Report and Order*, 27 FCC 359 (1959).

[9] Reorganization and Revision of Parts 1, 2, 21, and 94 of the Rules to Establish a New Part 101 Governing Terrestrial Microwave Fixed Radio Services, WT Docket No. 94-148, *Report and Order*, 11 FCC Rcd 13449 (1996).

[10] *See* Part 101, Subpart H.

[11] *See* Part 101, Subpart I. Part 101 also includes services licensed on a geographic area basis that allow both point-to-point and point-to-multipoint operations. *See* Part 101, Subparts G (24 GHz Service and Digital Electronic Messaging Service); L (Local Multipoint Distribution Service), and M (38.6-40.0 GHz Band). Part 101 also includes the Local Television Transmission Service (Part 101, Subpart J), the Multiple Address Service (Part 101, (continued....)

Commission's licensing regime for these two services requires frequency coordination and the filing of an application for each microwave link or path containing detailed information concerning the proposed operation.[12]

7. The frequency coordination process consists of giving prior notice to nearby licensees and applicants of the proposed operations, making reasonable efforts to avoid interference and resolve conflicts, and certifying that the proposed operation has been coordinated.[13] In order to secure such authorizations, applicants must specify the latitude and longitude of the transmitter in their applications to an accuracy of one second,[14] coordinate each operation specifying the transmitter location to an accuracy of one second.[15] and modify the license and coordinate any change to the location of the transmitter of more than five seconds in latitude or longitude or both.[16] Thus, if additional transmitters are added, the Commission's current rules require additional coordination and modification of the license.[17]

8. Microwave operations have an extensive history of sharing spectrum with other services. Two specialized microwave services - the Broadcast Auxiliary Service (BAS) and the Cable TV Relay Service (CARS) -- have not been consolidated into Part 101. In the bands that BAS and CARS share with Part 101 fixed services, they engage in the same frequency coordination process required of Part 101 services.[18] That includes the filing of an application for each microwave link or path containing detailed information concerning the proposed operation.[19] Additionally, in several bands, Part 101 licensees share spectrum with the Fixed Satellite Service (FSS) licensed under Part 25 of the Commission's Rules.[20] Both FSS and Part 101 licensees use frequency coordination to prevent interference.[21] Other Part 101 frequencies are shared by federal and non-federal users, and use of those frequencies must be cleared by the Interdepartment Radio Advisory Radio Committee.[22]

9. In general, spectrum below 13 GHz is preferred for long-link backhaul because signals can overcome the rain fading effects that limit transmission distances at higher frequencies. Over time, a considerable amount of spectrum in this range that had been allotted for microwave use has been reallotted for mobile wireless services.[23]

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Subpart O), the Multichannel Video Distribution and Data Service (Part 101, Subpart P), and service rules for the 70/80/90 GHz Bands (Part 101, Subpart Q).

[12] *See* 47 C.F.R. §§ 101.21(e), (f), 101.103.

[13] *See* 47 C.F.R. § 101.21(f).

[14] 47 C.F.R. § 101.103(d).

[15] *Id.*

[16] 47 C.F.R. § 1.929(d)(1)(i).

[17] 47 C.F.R. §§ 1.929(d)(1)(i), 1.947(a).

[18] *See* 47 C.F.R. §§ 74.638, 78.36.

[19] *See* 47 C.F.R. §§ 74.638, 78.36, 101.21(e), (f), 101.103.

[20] *See* 47 C.F.R. § 101.101.

[21] *See* 47 C.F.R. §§ 25.203, 101.103.

[22] *See* 47 C.F.R. § 2.106 (United States Table of Frequency Allocations).

[23] *See* 47 C.F.R. §§ 101.69-101.83, 101.85-101.97. Bands formerly used by microwave include the 1850-1990 MHz, 2110-2150 MHz, and 2160-2200 MHz bands.

IV. NOTICE OF PROPOSED RULEMAKING

10. Our review has three main parts. First, consistent with prior Commission actions, we offer proposals to increase sharing among broadcasters, cable television systems, and other fixed users to make additional spectrum available to these users. Second, we review certain Part 101 service rules and offer proposals to provide licensees with additional flexibility as well as to allow more reliable and intensive utilization of Part 101 spectrum. Finally, in the *Notice of Inquiry* that follows this section, we solicit further ideas for revising our Part 101 rules to provide additional flexibility for efficient use of scarce spectrum resources.

A. Making Additional Spectrum Available for Part 101 FS Operations

11. One avenue for meeting the increasing demand for FS for backhaul and other vital services is to permit FS operations in certain bands that have been reserved for specialized microwave services. In this *NPRM*, we believe it is vital to allow existing bands to be used for backhaul and other FS uses where possible. We propose to make 750 additional megahertz of spectrum available for FS uses by maximizing the opportunity for FS to share existing bands reserved for BAS and CARS, while fully protecting those incumbent operators, and increasing the flexibility of BAS operations. We emphasize that we are not proposing to modify existing licenses, and that any new licenses in this band will need to provide full protection for existing licensees. We also propose to provide BAS licensees with additional flexibility by allowing them to choose among a variety of channel bandwidths.

1. Background

12. Two services used by the mass media industry, BAS and CARS, share frequencies with Part 101 fixed services. BAS stations, licensed under Part 74 of the Commission's rules,[24] make it possible for television and radio stations and networks to transmit program material from the site of a breaking news story or a major event to the studio for inclusion in a broadcast program.[25] CARS stations, licensed under Part 78 of the Commission's Rules, are point-to-point or point-to-multipoint microwave systems used by cable systems to receive signals from remote locations or to distribute programming to microwave hubs where it is impossible or too expensive to run cable to those hubs.[26] As shown in Chart 1 below, Part 101, BAS and CARS already share the 6425-6525 MHz, 13.2-13.25 GHz, 17.7-18.3 GHz and 19.3-19.7 GHz bands.[27] Frequency coordination procedures have helped to minimize interference concerns among the services.

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[24] *See* Revisions to Broadcast Auxiliary Service Rules in Part 74 and Conforming Technical Rules for Broadcast Auxiliary Service, Cable Television Relay Service and Fixed Services in Parts 74, 78 and 101 of the Commission's Rules, ET Docket No. 01-75, *Notice of Proposed Rulemaking*, 16 FCC Rcd 10556, 10557 ¶ 1 (2001).

[25] *Id.*

[26] *See* Revisions to Broadcast Auxiliary Service Rules in Part 74 and Conforming Technical Rules for Broadcast Auxiliary Service, Cable Television Relay Service and Fixed Services in Parts 74, 78 and 101 of the Commission's Rules, ET Docket No. 01-75, *Report and Order*, 17 FCC Rcd 22979, 22980 n.1 (2002) (*BAS Service Rules Update R&O*).

[27] The Commission's Table of Frequency Allocations is codified at 47 C.F.R. § 2.106. We note that several bands listed in Chart 1 have important limitations. Part 101 use in the 2450-2500 MHz band is limited to certain grandfathered facilities. *See* 47 C.F.R. § 101.147(f)(2). The 6425-6525 MHz band lacks a fixed allocation. *See* 47 C.F.R. § 101.101 and 101.147(j). The 12.2-12.7 GHz band is allotted on a primary basis to the Direct Broadcast Satellite Service. *See* 47 C.F.R. § 25.202(a)(7). For limitations on the 17.7-19.7 GHz band, *see* 47 C.F.R. §

(continued....)

13. In 2000, the Commission determined that seven analog BAS and CARS channels, each occupying between 16.5 and 18 megahertz of bandwidth, could be replaced with seven digital channels that each occupied only 12 megahertz and created a compressed channel plan in the 2025 – 2110 MHz band onto which existing BAS and CARS operations were relocated.[28] The recovered spectrum would then become available for new satellite and, later, terrestrial services.[29] In 2002, the Commission amended Parts 74 and 78 of its rules to accommodate digital transmission in the Broadcast Auxiliary Service (BAS) and the Cable Television Relay Service (CARS).[30] In doing so, the Commission harmonized many of the rules governing BAS and CARS with rules that already applied to PS licensees under Part 101.

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101.147(r). In light of the important limitations in these bands, which are necessary in order to accommodate other services, we do not propose to offer new services in those bands.

[28] Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for use by the Mobile Satellite Service, ET Docket No. 95-18, *Second Report and Order and Second Memorandum Opinion and Order*, 15 FCC Rcd 12315 at ¶¶ 6, 12, 20 (2000) (*MSS Second R&O*).

[29] In the Matter of Improving Public Safety Communications in the 800 MHz Band, WT Docket 02-55, *Report and Order, Fifth Report and Order, Fourth Memorandum Opinion and Order, and Order*, 19 FCC Rcd 14969, 14999-15001 ¶¶ 55-57 (2004).

[30] *BAS Service Rules Update R&O, supra.*

Chart 1
Frequencies Available to TV Broadcast Auxiliary, CARS & Part 101 Fixed Services
That Are Not Auctioned and Have 10 MHz or More Maximum Authorized Bandwidth

Band	Common Carrier Fixed Point-to-Point (Part 101, Subparts C & I)	Local TV Transmission (Part 101, Subpart J)	Private Operational Fixed Point-to-Point (Part 101, Subparts C & H)	TV Broadcast Auxiliary (Part 74, Subpart F)	Cable TV Relay (Part 78)	Maximum Authorized Bandwidth (§§101.109 & 74.602)
2025-2110 MHz				X	X	12 MHz
2450-2500 MHz	X		X	X		Varies
3700-4200 MHz	X	X	X			20 MHz
5925-6425 MHz	X	X	X			30 MHz
6425-6525 MHz	X	X	X	X	X	25 MHz
6525-6875 MHz	X		X			30 MHz
6875-7125 MHz				X	X	25 MHz
10.55-10.68 GHz	X		X			
10.7-11.7 GHz	X		X			40 MHz
12.2-12.7 GHz			X			500 MHz
12.7-13.2 GHz				X	X	25 MHz
13.2-13.25 GHz	X	X	X	X	X	25 MHz
17.7-18.58 GHz	X		X	X	X	220 MHz
18.580-18.820 GHz	X		X			20 MHz
18.820-18.920 GHz	X		X			10 MHz
18.920-19.160 GHz	X		X			20 MHz
19.160-19.260 GHz	X		X			10 MHz
19.260-19.700 GHz	X		X	X	X	220 MHz
21.2-23.600 GHz	X		X			50 MHz

2. Discussion

14. One way to potentially increase the availability of microwave spectrum would be to allow FS operations to share spectrum in several bands at 13 GHz and below that are currently assigned to BAS and CARS, but not FS. As shown in Chart 1, there are three such bands: 2025-2110 MHz, 6875-7125 MHz, and 12700-13200 MHz. We tentatively conclude that the 2025-2110 MHz band would not be a good candidate for FS at this time because BAS incumbents have only recently been relocated to the 2025-2110 MHz band.[31] The recent repacking of the 2025-2110 MHz band was necessary to achieve important policy objectives, but the stresses and disruptions of that process, and the extensive number of BAS licensees in the band, do not make the 2025-2110 MHz band a good candidate for additional sharing among fixed services. Instead, we seek comment on introducing FS systems into 750 megahertz located in the 6875-7125 MHz and 12700-13200 MHz bands.

15. First, we propose to permit FS operations in the 6875-7125 MHz band, which is adjacent to existing FS operations in the 6525-6875 MHz band and well suited for backhaul and other microwave

[31] *See* July 15, 2010 *ex parte* filing of Sprint Nextel in WT Docket 02-55 and ET Dockets 00-258 and 95-18 announcing completion of BAS transition.

applications. In particular, we seek comment on sharing between mobile (temporary fixed) operations and fixed operations in the 6875-7125 MHz band where frequency coordination is not as formalized.[32] How will allowing fixed operations in this band affect the flexibility of broadcasters in arranging their ENG (Electronic News Gathering) operations? We note that in 2008, the Wireless Bureau modified ULS to allow BAS TV Pickup licensees the option to identify their stationary, receive-only sites on ULS to aid coordination with other services.[33] In light of the additional sharing proposed by this rulemaking, we also seek comment on whether we should make the identification of receive-only sites associated with TV pickup stations mandatory in the 6875-7125 MHz band.

16. Second, we propose to introduce FS systems into the 12700-13200 MHz band. This band is well suited for short to medium length backhaul microwave applications and in fact prior to 1988 was available to certain relocated FS systems.[34] Today, the 12700-13200 MHz band is primarily used by cable systems to deliver both video and broadband services.[35] It appears to be used mostly by less urban and smaller systems.[36] Though it is not used as extensively as it was previously, it is still critical to those systems that employ it. We seek comment on whether introduction of FS operations in this band, with the additional latitude proposed in this proceeding, will have an adverse impact on cable system operations and whether it will have an effect on future use of the spectrum by cable system operators.

17. Both the 6875-7125 MHz and 12700-13200 MHz bands are currently assigned to television pickup, television studio-transmitter links, television relay stations, television translator relay stations, and CARS.[37] We emphasize that we are not proposing to modify existing licenses and that any new licenses in this band will need to be frequency coordinated with existing licensees. We believe these uses would be compatible with FS operations with use of frequency coordination. The frequency coordination process has been highly successful in allowing maximum utilization of shared bands and eliminating potential interference problems. We therefore propose to require frequency coordination for new FS, BAS, and CARS stations in the 6875-7125 MHz and 12700-13200 MHz bands in accordance with our existing frequency coordination procedures. Commenters that believe that relying on our existing frequency coordination processes would not adequately address all necessary requirements should propose modifications to that process or alternative processes.

18. We seek comment on the best approach to channelization for the various bands under consideration. We note that existing operations in the 6875-7125 MHz and 12700-13200 MHz bands both use 25 megahertz bandwidth channels.[38] We note that this channelization scheme has been in existence for over 40 years.[39] Existing BAS operations in the 12700-13200 MHz band also use 25 MHz bandwidth

[32] *See, e.g.* 47 C.F.R. § 74.638(a) (oral coordination with less than 30 days' notice).

[33] See Wireless Telecommunications Bureau Announces ULS Upgrade, Licensees of Television Pick-Up Stations Now Have the Option of Identifying Their Stationary, Receive-Only Sites on ULS to Aid Coordination with Other Services, *Public Notice*, RM-11308, 23 FCC Rcd 6521 (WTB 2008).

[34] See 47 C.F.R. §101.147(a) n.22.

[35] *See* 47 C.F.R. § 78.11 for permissible uses of CARS stations.

[36] Based on staff review of COALS Electronic Filing System data.

[37] *See* 47 C.F.R. §§ 74.602(a), 78.18(a)(7). Licensees in the Local Television Transmission Service may use these frequencies to provide service to television broadcast stations, television broadcast network-entities, cable system operators, and cable network-entities. *See* 47 C.F.R. § 101.803(b).

[38] *See* 47 C.F.R. §§ 74.602(a), 78.18(a)(7).

[39] *See* Amendment of Parts 2, 21, 87, 89, 91, and 93 of the Commission's Rules to Reallocate, in Hawaii Only, the 6525-6575 Mc/s Band from the Motfile to the Fixed Service and to Permit Access to the Frequency Bands 6525-

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channels, while CARS operations in the band use 25 MHz, 12.5 MHz and 6 MHz channels. In recent years, we have generally assigned a variety of overlapping bandwidths within each Part 101 FS band so that applicants can choose a channel width appropriate for their needs.[40] As detailed in the rules appendix, we seek comment on a channelization scheme that would likewise provide applicants with a variety of channel widths to maximize flexibility and utilization of the 6875-7125 MHz and 12700-13200 MHz bands. Consistent with our recent action allowing 30 megahertz channels in the Upper 6 GHz Band,[41] we seek comment on alternative channelization schemes.

19. In addition, we propose to facilitate use of the 6875-7125 MHz and 12700-13200 MHz bands by BAS operators by making additional channel bandwidths available for their use. Such action would provide BAS licensees with additional flexibility and provide additional opportunities for using modern digital equipment.[42]

20. With respect to the remaining proposed technical rules for FS operation, we propose to apply the same technical parameters that currently apply to the Upper 6 GHz band to the adjacent 6875-7125 MHz band, because those bands are contiguous and should be able to use similar equipment. We believe that applying the rules currently applicable to the Upper 6 GHz Band to the 6875-7125 MHz band will facilitate equipment development and provide consistency to FS licensees. The specific rules that we propose are: (1) applying a maximum frequency tolerance of 0.005 percent;[43] (2) applying a maximum transmitter power of +55 dBw;[44] (3) applying the antenna standards currently applicable to Upper 6 GHz Band stations authorized after June 1, 1997 to the 6875-7125 MHz band;[45] (4) applying the capacity and loading requirements contained in Section 101.141(a)(3) of the Commission's Rules to this band;[46] and, (5) confirming that the 17 kilometer minimum path length requirement of Section 101.143 of the Commission's Rules would apply in the 6875-7125 MHz band.[47] We propose to retain the rules that are already applicable to the 12700 - 13000 MHz band,[48] with one exception. There is no minimum payload

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6575 and 6575-6875 Mc/s By Stations in the Domestic Public Radio Service in That State, Docket No. 16406, RM-836, *Report and Order*, 4 FCC 2d 1, 2 ¶ 8 (1966) (discussing allotment of 6875-7125 MHz band for Broadcast Auxiliary Service).

[40] *See* 47 C.F.R. § 101.147.

[41] *See* Amendment of Part 101 of the Commission's Rules to Accommodate 30 Megahertz Channels in the 6525-6875 MHz Band, *et al.*, WT Docket No. 09-114, RM-11417, *Report and Order*, FCC 10-109 (2010) (*6/23 GHz R&O*).

[42] In contrast, because CARS operations already have the opportunity to choose among a variety of channel bandwidths (*see* 47 C.F.R. § 78.18(a)), it does not appear necessary to propose different channel bandwidths for CARS operations in the 12700-13200 MHz band.

[43] *See* 47 C.F.R. § 101.107(a).

[44] *See* 47 C.F.R. § 101.113(a).

[45] *See* 47 C.F.R. §101.115(b)(2).

[46] 47 C.F.R. §101.141(a)(3).

[47] 47 C.F.R. §101.143.

[48] We note that prior to September 9, 1988 the 12700 – 13200 MHz band was available to the POFS service to accommodate stations that were licensed in the 12200 – 12700 MHz band prior to September 9, 1983. Part 101 already contains technical rules with respect to the 12700 – 13200 MHz band and we do not propose to alter those rules. We also note that private cable operators who use FS spectrum are also eligible to obtain CARS licenses in the 12700-13200 MHz band. *See* Amendment of Eligibility Requirements in Part 78 Regarding 12 GHz Cable Television Relay Service, CS Docket No. 99-250, *Report and Order*, 17 FCC Rcd 9930 (2002).

capacity applicable to the 12700-13200 MHz band. We propose to apply the minimum payload capacity and loading requirements that are currently applicable to the 11 GHz band to the 12700-13200 MHz band.[49] We seek comment on these proposals and any possible alternatives to them. We also seek comment on any special technical rules that might be necessary in that band.

B. Elimination of "Final Link" Rule

21. At the same time that we propose greater sharing of certain BAS and CARS bands with FS, we also propose to eliminate the "final link" rule, which will provide the broadcast industry with additional flexibility in using Part 101 spectrum for point-to-point communications. While broadcasters are allowed to obtain private fixed service licenses under Part 101 of the Commission's Rules, Section 101.603(a)(7) of the Commission's Rules prohibits broadcasters from using Part 101 stations as the final radiofrequency (RF) link in the chain of distribution of the program material to broadcast stations.[50] In light of recent technological and regulatory developments, we believe that the "final link" rule may no longer serve a useful purpose and, in fact, may inhibit the full use of Part 101 spectrum.

1. Background

22. In 1996, we simplified and streamlined the Part 101 rules to "encourage more efficient use of the microwave spectrum by permitting more intensive use of microwave equipment,"[51] and to "lead to economies of scale in microwave equipment production and lower equipment prices to licensees."[52] Section 101.603(a)(7) of the Commission's rules ensures that private operational fixed stations will be used only for private, internal purposes and prevents broadcasters from causing congestion when Part 74 Broadcast Auxiliary Service frequencies are available.

23. In recent years, the Wireless Telecommunications Bureau has granted a series of waivers of the "final link" rule to broadcasters.[53] In those cases, the applicants demonstrated that there were no BAS frequencies available that could accommodate their proposed operations and that use of Part 101 frequencies was necessary to establish a reliable link between the stations' main studios and transmitter sites.[54] Furthermore, successful waiver applicants also demonstrated that they intended to use the FS

[49] Our efficiency rules usually were not imposed on frequency bands above 12 GHz because of the higher amounts of fading on these frequencies compared to the lower bands, mostly due to oxygen and water vapor. However, in other parts of this rulemaking, we are proposing to allow flexible modulation schemes during anomalous weather events. We believe that the relaxation of the efficiency standards we are proposing due to anomalous weather events, such as rain fade, therefore, make it reasonable to impose the same efficiency standards for the 12.7-13.2 GHz band that we have for the 11 GHz frequency bands.

[50] 47 C.F.R. § 101.603(a)(7).

[51] Common Carrier and Private Operational Fixed Services, *Report and Order*, WT Docket No. 94-148, CC Docket No. 93-2, and RM-7861, 11 FCC Rcd 13449, 13452 (1996).

[52] *Id.* at 13453.

[53] *See* Denver Educational Broadcasting, Inc., *Memorandum Opinion and Order*, 24 FCC Rcd 14301 (WTB BD 2009); Greater Boston Radio, Inc., *Memorandum Opinion and Order*, 24 FCC Rcd 8661 (WTB BD 2009); Baybridge Communications, *Memorandum Opinion and Order*, 24 FCC Rcd 8653 (WTB BD 2009); AM/FM Radio Licenses, LLC, *Memorandum Opinion and Order*, 24 FCC Rcd 8649 (WTB BD 2009); Maryland Public Broadcasting Commission, *Memorandum Opinion and Order*, 21 FCC Rcd 1647 (WTB BD 2006).

[54] *See* Denver Educational Broadcasting, Inc., *supra*, 24 FCC Rcd at 14303 ¶ 5; Greater Boston Radio, Inc., *supra*, 24 FCC Rcd at 8663 ¶ 5; Baybridge Communications, *supra*, 24 FCC Rcd at 8655 ¶ 5; AM/FM Radio Licenses, LLC, *supra*, 24 FCC Rcd at 8651 ¶ 8.

station for purposes other than transmitting programming to the transmitter site, including data network services, emergency alert system warnings, ancillary connectivity, and control services.[55] In the case of Maryland Public Broadcasting Corporation, the waiver permitted MPBC to join a statewide microwave system, hastening by almost two years the provision of 911 and other emergency state services.[56]

2. Discussion

24. As broadcasters and other microwave users move to digital-based systems, we question whether it makes sense to maintain regulatory restrictions based on the type of content that the digital data transmitted by the system represents. As BAS and CARS move to digital and the technical rules have converged with those in Part 101, it has become difficult to distinguish video content from any other digital content or to distinguish a microwave link used for BAS and CARS from those licensed under Part 101. Indeed, broadcasters have shown increasing interest in using integrated microwave systems for data network services, real-time traffic information, and for transmitting an increasing amount of programming and other data to transmitter sites.[57]

25. Retaining the "final link" rule appears to be spectrally inefficient and places an unnecessary burden on broadcasters. Retaining the "final link" rule could force broadcasters to build unnecessarily redundant systems in the same locations: one system using reserved BAS frequencies for the sole purpose of delivering programming to a transmitter site and a second system using FS frequencies for other purposes. Especially in view of the increased sharing of BAS bands with FS stations we propose above, we believe it is appropriate to provide broadcasters with additional flexibility to use the FS bands.

26. We do not believe that eliminating the final link rule will crowd other FS licensees out of the band. Other rules require all FS licensees, including broadcasters, to build out their spectrum promptly[58] and to comply with minimum payload capacities.[59] These requirements serve to ensure productive use of the spectrum and to prevent noneconomic overuse. We note that FS licensees have argued in other contexts that these rules are sufficient to protect the efficient use of microwave spectrum.[60]

27. Accordingly, we seek comment on eliminating the "final link" rule. In considering this proposal, we encourage broadcasters to provide specific data on the efficiencies and cost savings that could result from eliminating this rule. FS licensees who oppose this change should identify the harms they believe would be caused by eliminating this rule and explain why they believe other rules are

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[55] *Id.*

[56] Maryland Public Broadcasting Commission, *supra*, 21 FCC Rcd at 1648, 1650 ¶¶ 3, 7.

[57] *See, e.g.*, Waiver Request of Greater Boston Radio, Inc., File No. 0003242058 (filed Nov. 27, 2007) at 2-3; Waiver Request of Baybridge Communications, File No. 0003193277 (filed Oct. 8, 2007) at 2.

[58] 47 C.F.R. § 101.63(a) requires that each FS station (except for certain upper microwave services not at issue here) must be constructed within 18 months of the date of grant.

[59] *See* 47 C.F.R. §101.141(a)(3).

[60] *See* Comments of the Fixed Wireless Communications Coalition, WT Docket No. 09-114 (filed Aug. 21, 2009) at 2-3, *citing* 47 C.F.R. § 101.141(a); Comments of AT&T, Inc., WT Docket No. 09-114 (filed Aug. 21, 2009) at 3-4; Comments of Clearwire Corporation, WT Docket No. 09-114 (filed Aug. 17, 2009) at 1; Comments of National Spectrum Managers Association, WT Docket No. 09-114 (filed Aug. 21, 2009) at 2; Comments of Tier One Converged Networks, Inc., WT Docket No. 09-114 (filed Jul. 24, 2009) at 1; Comments of Cielo Networks, Inc., WT Docket No. 09-114 (filed Jul. 27, 2009) at 1.

insufficient to prevent those harms. We also seek comment on whether there are alternatives that could facilitate broadcaster access to FS spectrum while retaining that prohibition under certain circumstances.

C. Adaptive Modulation

28. In this section, we propose changes to our rules to allow FS licensees to maintain communications when adverse propagation characteristics would otherwise force communications to be terminated. Specifically, we propose to amend our rules to allow licensees to temporarily drop below minimum payload capacity requirements specified by the rules in certain limited circumstances. These proposed rule changes have the potential to reduce operational costs and increase reliability, which could be particularly important in facilitating the use of wireless backhaul in rural areas.

1. Background

29. Section 101.141(a)(3) of the Commission's Rules establishes minimum payload capacities (in terms of megabits per second) for various channel sizes in certain Part 101 bands.[61] The underlying purpose of the rule is to promote efficient frequency use.[62] Although the Commission has never quantified the time period over which licensees must comply with those standards, the industry has generally construed the payload requirements as applying whenever the link is in service.[63]

30. On May 8, 2009, Alcatel-Lucent, Dragonwave, Inc. Ericsson, Inc., Exalt Communications, Fixed Wireless Communications Coalition (FWCC), Harris Stratex Networks and Motorola, Inc. ("Petitioners") filed a request for interpretation of the Commission's Rules.[64] Petitioners ask the Bureau to interpret Section 101.141(a)(3) of the Commission's Rules to permit data rates to drop for brief periods below the minimum payload capacity specified in the rules, instead of temporarily having a link go completely out of service, so long as the values mandated by the rules were maintained both in normal operation and on average.[65] Petitioners assert that fixed service links, especially long links, are subject to atmospheric fading: a temporary drop in received power caused by changes in propagation conditions.[66] Fading leads to an increase in bit errors, and sometimes to a complete loss of communications.[67] According to Petitioners, one way to combat fading is by briefly reducing the data rate, which requires a temporary change in the type of modulation, a process called "adaptive modulation."[68] Petitioners acknowledge that the use of adaptive modulation may reduce the minimum payload capacity below the value specified in the rule for a short time, although this still represents an increase over the otherwise zero level during the fade.[69] Petitioners further allege that, in a properly designed system, fading

[61] 47 C.F.R. §101.141(a)(3).

[62] *See* Reorganization and Revision if Parts 1, 2, 21 and 94 of the Rules to Establish a New Part 101 Governing Terrestrial Microwave Fixed Radio Service, *Report and Order*, WT Docket No. 94-148, 11 FCC Rcd 13449, 13476 ¶ 77 (1996).

[63] *See* Request of Alcatel-Lucent, et al. for Interpretation of 47 C.F.R. §101.141(a)(3) To Permit Use of Adaptive Modulation Systems, WT Docket No. 09-106 (May 8, 2009) (FWCC Request) at 2.

[64] *Id.*

[65] *Id.* at 2.

[66] *Id.* at 3. Because water vapor is one of the primary causes of that fading, the fading is often referred to as "rain fading."

[67] *Id.*

[68] *Id.*

[69] *Id.*

conditions that might trigger adaptive modulation occur well under one percent of the time, and thus, even under pessimistic assumptions, a system employing adaptive modulation will comfortably achieve the minimum on average.[70] They assert that the proposed reading of the rule fully maintains the rule's purpose by enhancing spectrum efficiency.[71] Finally, Petitioners also state that the interpretation would allow for the continued handling of critical traffic when the link would otherwise be inoperative and that the use of adaptive modulation could preserve network synchronization during fading which could eliminate several additional minutes of outage.[72]

31. The Bureau sought comment on the FWCC Request on June 25, 2009.[73] Most commenters supported the request. Supporters argue that adaptive modulation can significantly improve the performance and reliability of microwave systems,[74] ensure that links remain operational when they would otherwise be out of service,[75] and ensure more efficient spectrum use by maximizing the data carrying capabilities of backhaul radio infrastructure.[76]

32. Verizon and other commenters disagree with this viewpoint, arguing that the proposed interpretation is inconsistent with the underlying purpose of the rule and should not be adopted without "appropriate and enforceable limits or conditions that would ensure its spectral efficiency goals are met."[77] Specifically, Verizon expresses concern that basing compliance on an "average" data rate would allow licensees to deploy systems operating with spectrally inefficient, low data rate systems part of the time.[78] X-Dot, Inc. agrees with Verizon that the FWCC Request has the potential to cause spectrum inefficiency and limit spectrum availability for future users.[79]

33. The parties disagree on the procedural disposition of the petition. Verizon argues that the Bureau cannot offer relief under the guise of a rule interpretation and that a rulemaking would be necessary.[80] FWCC, on the other hand, argues that a rulemaking proceeding is unnecessary and expresses concern about the time a rulemaking would take.[81] FWCC also argues that their requested interpretation

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[70] *Id.*

[71] *Id.* at 4.

[72] *Id.*

[73] Wireless Telecommunications Bureau Seeks Comment on Request of Alcatel-Lucent, *et al.* for Interpretation of 47 C.F.R. § 101.141(a)(3) to Permit the use of Adaptive Modulation Systems, Public Notice, WT Docket No. 09-106, 24 FCC Rcd 8549 (WTB 2009).

[74] *See* Comments of Fixed Wireless Communications Coalition, WT Docket No. 09-106 (filed Jul. 27, 2009) at 2; Comments of Clearwire Corporation, WT Docket No. 09-106 (filed Jul. 27, 2009) at 1-2.

[75] *See* Comments of AT&T, Inc., WT Docket No. 09-106 (filed Jul. 27, 2009) at 2; *See* Comments of United States Cellular Corporation, WT Docket No. 09-106 (filed Jul. 27, 2009) at 2.

[76] *See* Comments of DragonWave, Inc., WT Docket No. 09-106 (filed Jul. 27, 2009) at 1.

[77] Comments of Verizon and Verizon Wireless, WT Docket No. 09-106 (filed Jul. 27, 2009) at 3.

[78] *Id.* at 2.

[79] Reply Comments of X-Dot, Inc., WT Docket No. 09-106 (filed Aug. 11, 2009).

[80] *See* Reply Comments of Verizon Wireless, Verizon Communications, Inc., and subsidiaries, WT Docket No. 09-106 (filed Aug. 11, 2009) at 2-3 (Verizon Reply).

[81] *See* FWCC Reply Comments at 9-10.

of the Section 101.141(a)(3) is consistent within the present wording of the rule, and does not cause any possible disadvantage to other users of the spectrum.[82]

34. On May 14, 2010, FWCC followed up its original Request for Interpretation with a Request for Waiver of Section 101.141(a)(3) so that it can utilize adaptive modulation to average bit rates over time to combat fading.[83] FWCC acknowledges the Commission's indication in the National Broadband Plan that it intends to open a rulemaking with regards to adaptive modulation; however, FWCC argues that it urgently needs relief with respect to adaptive modulation and does not want to wait for a rulemaking cycle to be completed.[84]

2. Declaratory Ruling

35. We agree with Verizon that a rulemaking is necessary to implement the policy interpretation sought in the FWCC Request and we therefore deny the FWCC Request for declaratory ruling in this instance because the requested interpretation is inconsistent with the plain language of the current rule. The current rule specifies a "minimum" payload capacity, which commenters admit has been interpreted to mean that it must be complied with at all times when the system is in operation.[85] Such an interpretation is consistent with the use of the word "minimum." FWCC's proposed interpretation deviates from the commonly understood meaning of the rule. Furthermore, the fact that licensees had interpreted the rule as establishing a benchmark that must be complied with at all times is further evidence that it would not be appropriate to change the meaning of an established rule under the guise of a declaratory ruling. We also note that the comments raise various policy issues that are best addressed through the rulemaking process.

3. Rulemaking

36. We believe that it is in the public interest to commence a rulemaking proceeding to amend our rules to facilitate the use of adaptive modulation by allowing licensees to maintain communications in the face of adverse propagation characteristics. Adaptive modulation has the potential to reduce operational costs and facilitate the use of wireless backhaul in rural areas. While our current rules allow the use of adaptive modulation, they would require all modulation modes to comply with the minimum payload capacities contained in the rules at all times.[86] Allowing carriers to operate below the current efficiency standards for short periods when it is necessary to maintain an operational link, without a need for waiver, could enable carriers to save on costs and enhance reliability of microwave links. Accordingly, we seek comment in the context of this *NPRM* on revising Section 101.141 of the Commission's Rules to allow greater use of adaptive modulation by FS licensees.

37. It may be appropriate to allow licensees to operate for some period of time below the minimum efficiency standards. Adaptive modulation can allow communications to be maintained during adverse propagation conditions. Given the critical backhaul and public safety applications of FS stations, we find this benefit to be significant. By allowing this level of flexibility in our efficiency standards we hope to provide carriers with a way to lower their costs yet still use the spectrum efficiently.

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[82] *See* FWCC Request at 4; 47 C.F.R. § 101.141(a)(3).

[83] *See* Fixed Wireless Communications Coalition Request for Temporary Waiver of Section 101.141(a)(3) of the Commission's Rules (filed May 14, 2010) at 1-2 (FWCC Waiver Request).

[84] *See Id.* at 3-4.

[85] *See* FWCC Request at 2.

[86] *See* 47 C.F.R. § 101.141(a)(3).

38. We are concerned, however, that the proposal to allow compliance with the efficiency standards "on average" and "during normal operation" is too vague and open-ended. Commenters have noted that it is standard engineering practice to design microwave links to have 99.995 percent or higher link availability.[87] Under those circumstances, we believe the standard proposed in the FWCC Request would give licensees too much latitude to deploy inefficient systems that would be inconsistent with good engineering practices. To the extent the underlying concern behind this proposal is that the requirements of the rule are too strict and inhibit full use of the spectrum, we believe the better approach would be to review those standards and amend them, if appropriate.[88] Moreover, using an "on average" standard would make enforcement of the minimum payload capacity rule more difficult. We also tentatively conclude that the equipment restrictions proposed by Verizon would not be in the public interest because, as noted by HSX, such restrictions could increase equipment prices for carriers and consumers.

39. We tentatively conclude to adopt a more carefully tailored approach by amending Section 101.141 of the Commission's Rules to state that the minimum payload capacity requirements must be met at all times, except during anomalous signal fading, when lower capacities may be utilized in order to maintain communications. This approach will allow licensees to take advantage of the benefits of adaptive modulation without unduly undercutting the efficiency purpose that led to initial adoption of the minimum efficiency requirement. We seek comment on this proposal, as well as alternatives. We also seek comment on what might constitute anomalous signal fading. We also propose to adopt AT&T's suggestion to require licensees that wish to be able to temporarily use modulations below the minimum payload capacity in Section 101.141 of the Commission's Rules to state that fact in their prior coordination notices. We seek comment on whether, how, and to what extent this information should be logged and made part of the station records under Section 101.217[89] to facilitate enforcement. We also seek comment on related issues, including whether the rules should specify a minimum amount of time a link is operational or a minimum efficiency standard below which an FS station may not fall even when using adaptive modulation.

40. Finally, we deny FWCC's Waiver Request. We may grant a request for a waiver when: (i) the underlying purpose of the rules(s) would not be served or would be frustrated by application to the instant case, and a grant of the requested waiver would be in the public interest; or (ii) in view of the unique or unusual factual circumstances of the instant case, application of the rule(s) would be inequitable, unduly burdensome, or contrary to the public interest, or the applicant has no reasonable alternative.[90] FWCC has failed to make a showing under either prong of the waiver standard. Given the concerns we have regarding FWCC's proposal to use an "on average" standard, FWCC has not shown that it would be in the public interest to allow operation under such circumstances. Furthermore, FWCC's claims that there is an urgent need for relief are conclusory and lack any specificity. We therefore conclude that the better course is to proceed through our normal rulemaking process and determine the best means of allowing licensees to take advantage of adaptive modulation.

D. Auxiliary Stations

41. In this section, we seek comment on a proposal to allow substantially greater spatial reuse of microwave spectrum, thereby potentially reducing the cost of using FS spectrum for backhaul and other

[87] *See* Clearwire Comments at 2 (99.995% availability); Verizon Comments at 3 (99.999% or higher availability); HSX Comments at 2 (99.99-99.999% availability)

[88] *See* Section V B., *infra*.

[89] 47 C.F.R. § 101.217.

[90] 47 C.F.R. § 1.925(b)(3).

important purposes. Specifically, we propose to allow FS licensees to operate "auxiliary stations" in conjunction with existing microwave links, subject to conditions designed to enable the use of such stations to augment capacity while safeguarding existing users in the band.

1. Background

42. The Commission's current rules define a fixed station as "[a] station operating at a fixed location,"[91] and require a license for each station.[92] In the Part 101 Operational Fixed Services, the rules require evaluation of proposed point-to-point fixed microwave stations on a site-by-site, path-by-path basis, and do not provide exceptions based on the aggregation of multiple sites and paths. Each license application must include "all technical information required by the application form and any additional information necessary to fully describe the proposed facilities and to demonstrate compliance with all technical requirements of the rules governing the radio service involved . . . ."[93] This construct is different from services based on geographic area licensing, where a licensee, subject to certain exceptions, is allowed to place transmitters throughout its service area without individual Commission approval once it has obtained its geographic area license, subject to compliance with applicable service rules.[94]

43. On February 23, 2007, Wireless Strategies, Inc. (WSI) filed a petition asking the Commission to issue a declaratory ruling "confirming that a Fixed Service licensee is permitted to simultaneously coordinate multiple links whose transmitter elements collectively comply with the Commission's antenna standards and frequency coordination procedures."[95] WSI claimed that its proffered "interpretation" of the Commission's Rules would enhance spectrum efficiency by allowing a licensee to reuse the licensed spectrum in a given area. In support of its proposal, WSI maintains that the requested ruling would "directly support stated Commission goals: to maximize efficient use of spectrum; to minimize regulation where appropriate; and to facilitate innovative service and product offerings."[96] Comment on WSI's petition was sought by Public Notice,[97] and 27 parties filed comments, reply comments and *ex parte* statements.

44. As described by WSI in its petition, supporting comments and *ex parte* filings, WSI's proposal rests on the premise that once a microwave link is successfully coordinated and licensed, additional auxiliary links can be designed to re-use the same frequency near the coordinated/licensed transmitter without causing harmful interference to other microwave links.[98] WSI describes the additional

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[91] 47 C.F.R. § 1.907.

[92] 47 C.F.R. § 1.903(a).

[93] 47 C.F.R. § 101.21. *See also* 47 C.F.R. § 1.923.

[94] *See, e.g.*, 47 C.F.R. § 27.1209(b).

[95] Request for Declaratory Ruling filed by Wireless Strategies, Inc., WT Docket No. 07-121 (filed Feb. 23, 2007) (WSI Petition) at 1. WSI describes itself as a "carrier's carrier" whose "mission is to engineer, provision, operate, lease and/or sell Concurrently Coordinated licensed microwave networks in every city and town across the United States." *See* http://www.wirelessstrategies.net (last visited May 25, 2010).

[96] WSI Petition at 8.

[97] Wireless Telecommunications Bureau Seeks Comment on Request for Declaratory Ruling by Wireless Strategies, Inc. Regarding Coordination of Microwave Links under Part 101 of the Commission's Rules, *Public Notice*, 22 FCC Rcd 11133 (2007). A list of commenters is attached as Appendix D.

[98] WSI Petition at 5-7.

links as "concurrently coordinated" because they are coordinated simultaneously with, and ancillary to, the main beam,"[99] and it describes the resulting networks as "Smart Antennas with Distributed Radiating Elements" or "DREs."[100] WSI maintains that these ancillary links should be allowed to operate "subject to conditions that (1) all radiating elements together conform to the applicable radiation pattern in Section 101.115 [of the Commission's rules], and (2) all links are successfully coordinated."[101]

45. In its original proposal, WSI proposed that that it would be unnecessary to separately coordinate auxiliary elements within the side lobes of the main station because "the antenna characteristics provided by the applicant to the coordinator, in addition to describing the main lobe, also incorporate the properties of the multiple distributed elements to be used for communication with other locations."[102] WSI referred to that concept as "concurrent coordination."[103] In response to arguments that coordination of the auxiliary elements is necessary, WSI modified its proposal. Specifically, WSI suggests that, once a "main link" is successfully coordinated and licensed, an auxiliary element would only be added (1) following regular frequency coordination and filing of an application for major modification of the license of the associated location whose frequency it would reuse, and (2) on a secondary basis to any future coordinated paths.[104]

46. The WSI Petition had several supporters and a number of opponents. Supporters assert that the proposal would allow the deployment of smart antenna systems supporting the deployment of additional services.[105] WSI claims that it would dramatically lower the cost of operating multiple paths and allow operators "to lower the size of antennas to one-foot or less, reuse the licensed frequencies multiple times, and dramatically lower the equipment cost per path."[106] After initially opposing the WSI Petition, Sprint subsequently stated that it believes, "WSI's proposal has the potential for permitting far more efficient use of the microwave spectrum, while also enabling licensees and users to implement microwave links on a less costly, better-scaled and more expedient basis."[107] Similarly, San Diego Gas & Electric Company and Southern California Gas Company believe that WSI's proposal holds promise for extending the reach and flexibility of its existing wireless backbone network, enabling

[99] *Id.* at 7.

[100] *See, e.g.*, WSI Reply Comments to the Fixed Wireless Communications Coalition's Letter of March 26, 2007, WT Docket No. 07-121 (filed Apr. 26, 2007) at 2.

[101] WSI Petition at 7-8. Note that while WSI uses the term DREs, we believe "auxiliary stations" is more accurate, and will hereinafter use this term.

[102] *Id.* at 7.

[103] *Id.*

[104] *See* Letter from Michael Mulcay, Chairman Wireless Strategies Inc., WT Docket No. 07-121 (filed Mar. 19, 2009) (WSI March 19 *Ex Parte*).

[105] See Comments of AirTegrity Wireless, Inc., WT Docket No. 07-121 (filed Jul. 19, 2007) at 2; Comments of Bridgeway Systems, Inc., WT Docket No. 07-121 (filed Jul. 19, 2007) at 2; Comments of Proximetry, Inc., WT Docket No. 07-121 (filed Jul. 19, 2007) at 2; Comments of Ferris, Baker Watts, Inc., WT Docket No. 07-121 (filed Jul. 19, 2007) at 1.

[106] *See* WSI March 19 *Ex Parte* at 1, 8.

[107] Letter from Richard B. Engelman, Director, Spectrum Resources, Sprint Nextel Corporation, WT Docket No. 07-121 (filed Mar. 12, 2009) at 2.

critical connectivity into local neighborhoods and associated metering/monitoring points on a point-to-multipoint basis.[108]

47. In contrast, opponents state that the WSI Petition is inconsistent with the Commission's frequency coordination and antenna standards rules.[109] On policy grounds, the opponents argue that (1) WSI's proposed point-to-multipoint mode of operation is incompatible with traditional point-to-point FS operations,[110] (2) WSI is improperly attempting to create protected geographic areas in Part 101 spectrum;[111] (3) the kinds of operation that WSI proposes will cause excessive interference to other users of the spectrum and would hurt the reliability and integrity of existing systems;[112] (4) WSI's proposal is not a legitimate implementation of the "smart antenna" concept;[113] and (5) allowing operation in the mode WSI contemplates would exacerbate the increasing congestion in FS bands and make spectrum unavailable for traditional point-to-point applications.[114]

2. Declaratory Ruling

48. Initially, we determine that the WSI Proposal is not consistent with our rules as currently drafted, and we therefore deny the request for declaratory ruling. In describing the operations it envisions, WSI considers only the performance of auxiliary stations collectively with the associated primary station. For example, it describes antennas[115] at auxiliary sites that do not meet the performance requirements of Section 101.115 of the Commission's Rules.[116] Nevertheless, WSI maintains that establishing auxiliary stations is consistent with the Commission's rules since, in its view, Sections 101.103[117] and 101.115 do not require specification of the physical characteristics of antennas or the

[108] Reply Comments of San Diego Gas & Electric Company and Southern California Gas Company, WT Docket No. 07-121 (filed Aug. 20, 2007) at 4.

[109] 47 C.F.R. § 101.103 and 47 C.F.R. § 101.115, respectively..

[110] Comments of Harris Stratex Networks, Inc., WT Docket No. 07-121 (filed Jul. 19, 2007) (HSX Comments) at 8; Comments of the National Spectrum Managers Association, WT Docket No. 07-121 (filed Jul. 19, 2007) (NSMA Comments) at 3, 7-8; Comments of the Society of Broadcast Engineers, Inc., WT Docket No. 07-121 (filed Jul. 19, 2007) at 3-4; Reply Comments of the American Petroleum Institute, WT Docket No. 07-121 (filed Aug. 20, 2007) (API Reply) at 6.

[111] NSMA Comments at 3; Opposition of Alcatel-Lucent to Request for Declaratory Ruling, WT Docket No. 07-121 (filed Jul. 19, 2007) (Alcatel-Lucent Opposition) at 6-8; Reply Comments United States Cellular Corporation, WT Docket No. 07-121 (filed Aug. 20, 2007) at 5-7.

[112] HSX Comments at 8; Comments of TerreStar Networks, Inc. and Mobile Satellite Ventures Subsidiary LLC, WT Docket No. 07-121 (filed Jul. 19, 2007) (TerreStar/MSV Comments) at 4; Comments of Comsearch, WT Docket No. 07-121 (filed Jul. 19, 2007) (Comsearch Comments) at 6-9; Reply Comments of the Fixed Wireless Communications Coalition, WT Docket No. 07-121 (filed Aug. 20, 2007) (FWCC Reply) at 3.

[113] Comsearch Comments at 4-6, HSX Comments at 7-8.

[114] Alltel-Lucent Opposition at 11-12; API Reply at 6-7.

[115] *See, e.g.*, WSI Mar. 19, 2009 *Ex parte*, at 4 (specifying "a small flat panel antenna (6in x 6in x 1in) having a gain of 18 dBi").

[116] 47 C.F.R. § 101.115.

[117] 47 C.F.R. § 101.103.

physical location of each element of a smart antenna.[118] Instead, WSI argues, "the rules specify antenna performance, but are flexible on how that performance can be achieved."[119]

49. WSI's proposal to consider the performance of a system on an aggregate basis is not consistent with the plain wording of our rules for two reasons. First, the rules require evaluation of proposed point-to-point fixed microwave stations on a site-by-site, path-by-path basis, and do not provide exceptions based on the aggregation of multiple sites and paths.[120] Second, WSI's proposal is inconsistent with the antenna standards rule, Section 101.115 of the Commission's Rules, because it proposes the use of antennas that do not meet those standards. The rules provide that all fixed stations must use antennas that meet the applicable performance standard.[121] In the WSI model, the various antennas in a cluster do not operate as one.[122] When any given antenna in a cluster is radiating, the other antennas in the cluster are not. Thus, there is no composite radiation mode that can meaningfully be analyzed apart from the performance of each station individually.[123] This situation is not changed simply because a licensee would coordinate the timing of each site's transmissions to prevent intra-cluster interference, or would design the auxiliary stations with the goal of causing no greater interference to others than the associated primary station. Each site must be considered a separate station, with the potential to cause interference to other stations, and consequently each site is individually subject to the rules governing fixed microwave stations.[124] The rules make no provision otherwise. We therefore deny WSI's Request for Declaratory Ruling because its proposal is not consistent with the rules as they currently exist.

3. Rulemaking

50. While we find that the concept proffered by WSI is not consistent with the current rules, we do find it worthy of further consideration. Because we cannot authorize this operation as a declaratory ruling, we seek comment in this *NPRM* on whether we should make changes, as necessary, to our Part 101 rules to afford licensees the opportunity to operate in this manner. WSI and other proponents argue that the proposed operations contemplated by WSI may have the potential to allow substantially greater reuse of microwave spectrum and thereby reduce the cost of using FS spectrum for backhaul and other important purposes. Under those circumstances, we find that it is in the public interest to initiate a rulemaking proceeding on our own motion to consider changes to our Part 101 rules to allow operation in the manner contemplated by WSI. A rulemaking proceeding will allow us to gather information on the

[118] Before clarifying that each auxiliary station would undergo coordination and licensing, WSI had argued that, "Certainly the main station antenna will be specified in compliance with the Rules. As there is no need to specify DRE locations, the omission of this information will not render [an] application incomplete." WSI Reply Comments at 14.

[119] WSI Petition at 9.

[120] *See* 47 C.F.R. § 101.21.

[121] *See* 47 C.F.R. § 101.115(b).

[122] For this reason, we refer to these additional points of communication as auxiliary stations rather than DRE's.

[123] This situation is thus completely different from considering the individual components making up an antenna, whether, for example, a phased-array smart antenna as that term is commonly understood or a conventional parabolic dish antenna.

[124] Section 301 of the Act requires the licensing of "any apparatus for the transmission of energy or communications or signals by radio. Section 308 assigns to the Commission responsibility for establishing the licensing process. 47 U.S.C. §§ 301, 308.

proposed types of operations, discuss specific rule changes, and consider further the arguments for and against the operations that WSI contemplates.

51. As WSI correctly states, FS stations do not direct all of their energy towards their respective reception antennas. A curved antenna focuses the radio beam in a certain direction, but the beam spreads gradually wider in a fan shape until it dissipates below the ambient noise threshold or encounters an obstacle. Regardless of how focused the antenna may be, the transmitter also spills a certain amount of energy in all directions, in a roughly circular shape. Overlaid on each other, the circle and the fan together produce a keyhole-shaped signal pattern. This characterization is oversimplified, of course, but it will suffice for purposes of the discussion below.

Picturing a keyhole-shaped signal pattern helps to visualize the preclusive effect that an FS station creates with respect to stations sharing the same spectrum, but doing so does not tell the whole story. An FS licensee is entitled to prevent another licensee's signal from traversing its signal pattern if, but only if, that trespass interferes with the original licensee's ability to receive its signal at its downlink station. Thus, for example, another licensee might transmit a signal at right angles to the original licensee's signal, crossing at its midpoint, without creating unacceptable interference. In such a case, our rules and the frequency coordination process would normally allow the second link to be deployed.

52. As is fleshed out in greater detail below, we seek comment on the potential benefits of permitting auxiliary stations under our Part 101 rules – the uses they may support, the efficiencies that may be achieved – as well as on the potential harms. Reserving judgment on the ultimate balancing of those benefits and harms, we observe that a series of changes to our Part 101 rules would be necessary in order to effectuate a Part 101 regime including auxiliary stations. Specifically, we seek comment on the following elements of such a regime:

- Each auxiliary station must operate on the same frequencies as the main licensed link.
- Auxiliary stations must not cause any incremental interference to other primary links, i.e., they must not cause any more interference to them than the main link would cause. This result can, possibly, be achieved by alternating transmissions between the primary station and the auxiliary stations on a time-division multiplexed basis or by any other method that achieves the required result.
- Auxiliary stations will be secondary in status and have no right to claim protection from interference from any primary stations, including stations in other services, such as BAS, CARS, and satellite stations, other than interference that violates the protection rights of the main link. Otherwise, auxiliary stations will have a right to claim protection only from later-deployed auxiliary stations.

- Auxiliary stations would have to be coordinated in advance with other licensees and applicants pursuant to the frequency coordination process specified in Section 101.103 of the Commission's Rules.

- After coordination, the licensee of the main link would file applications to make major modifications to the main link license to add auxiliary stations. In those bands where conditional authority is available, applicants could operate their auxiliary stations as soon as they complete the frequency coordination process and file their application with the Commission, subject to the usual conditions and exceptions to conditional authority.[125] Alternatively, we seek comment on whether, consistent with the procedures set out in Section 101.31 of our Rules for temporary fixed links, we could allow main link licensees to file blanket applications to operate temporary auxiliary stations at multiple locations within specified geographic areas surrounding the associated main links.

- Until we gain further experience with system operation under these new rules, we further propose to require that auxiliary stations be restricted from communicating directly with each other, i.e., that they be allowed to communicate directly only with the primary link's transmitter or receiver. We propose this restriction because it would reduce the chance of interference.

- Auxiliary stations would not be subject to the antenna standards or minimum path length requirements that apply to main links.[126] Eliminating the beamwidth requirement will enable licensees to use smaller, less expensive antennas that put less of a load on support structures and thereby reduce the cost of those structures. The main link, however, would still have to comply with those requirements.

- Main links would remain subject to existing loading and path length requirements, but auxiliary stations would be exempt from the loading and path length requirements.[127] Alternatively, in determining compliance with the loading requirements, licensees would be allowed to aggregate loading on the main link and auxiliary stations. We seek comment on both alternatives. Parties supporting the second alternative should explain how to avoid double counting traffic between a main link and an auxiliary link that also traverses the main link.

- Like primary stations, auxiliary stations would be required to obtain the necessary approvals for FAA tower clearance and to comply with environmental requirements covering non-ionizing radiation hazards, zoning, the National Environmental Act of 1969 and the National Historical Act of 1966, as applicable.[128]

We believe these proposed rule changes could facilitate the provision of advanced backhaul services in the FS bands while providing protection to existing users in the band. We seek comment on these proposals, as well as alternatives.

53. We note that FS and satellite users raised concerns about the proposal in the record on the WSI Petition, arguing that it is inconsistent with the frequency coordination[129] and antenna standards[130]

[125] *See* 47 C.F.R. § 101.31(b).

[126] *See* 47 C.F.R. §§ 101.115, 101.143.

[127] *See* 47 C.F.R. §§ 101.141(a)(3), 101.143.

[128] See 47 C.F.R. Part 1, Subpart I, and Part 17.

[129] 47 C.F.R. § 101.103.

rules. Our main concerns are avoiding interference to existing operations in the bands, maintaining the reliability and integrity of existing systems, and avoiding a situation where spectrum becomes unavailable to FS applicants and other users that share spectrum with FS. In order to compare the relative benefits and risks of allowing auxiliary stations, we request additional information from commenters.

54. Initially, we seek more specific information on the types of operations for which auxiliary stations could be used. Information that would be useful would include: (1) an estimate of how many systems parties contemplate operating with auxiliary stations, (2) information on whether such systems would typically be deployed in urban or rural areas, (3) the types of uses to which such systems would be put, (4) the contemplated distances between the auxiliary stations and the main link, and (5) the relative amount of traffic anticipated to be carried on the main link versus the auxiliary links.

55. We also seek comment on whether the contemplated operations could be accommodated in existing Part 101 services and bands that allow point-to-multipoint operation, such as the Local Multipoint Distribution Service, the 24 GHz Service, and the operations in the 38.6-40.0 GHz band. Those bands feature geographic area licensing that would appear to be well suited for the type of operations involving multiple stations, whether "auxiliary" or primary.

56. We note that the examples WSI provides propose use of the Lower 6 GHz Band (5925 MHz - 6425MHz).[131] Recently, we noted that that band has become highly congested and that there are areas where it is impossible to coordinate 30 megahertz bandwidth links.[132] While the Commission authorized 30 megahertz bandwidth links in the Upper 6 GHz Band in the *6/23 GHz R&O*, we anticipate that there will be considerable demand for those frequencies. We seek comment on whether there is sufficient capacity in those bands to accommodate many operations of the type contemplated by WSI, in addition to the existing uses in the band. We are particularly interested in the experiences of parties who have coordinated links in that band.

57. We seek comment on whether our proposal would strike the appropriate balance between auxiliary stations and other operations, particularly primary microwave links. We propose requiring frequency coordination and adding auxiliary sites to the license through our normal application process and seek comment on whether those requirements would be sufficient protection. Furthermore, given that auxiliary stations would be secondary to main links and could not be used to prevent coordination of main links, it appears unlikely that they could be used to establish pseudo-geographic service areas. We seek comment on concerns raised by some commenters that auxiliary links could give applicants an incentive to propose main links that would allegedly specify excessive power, and would allegedly be designed to maximize interference and the preclusive effect on other nearby operations.[133] We seek comment on the applicability of Section 101.103(d) (1) of the Commission's Rules, which requires applicants to avoid interference in excess of permissible levels to other users and requires applicants to make "every reasonable effort" to avoid blocking the growth of prior coordinated systems, to main links associated with auxiliary stations.[134]

(...continued from previous page)

[130] 47 C.F.R. § 101.115.

[131] *See, e.g.*, WSI March 19 *Ex Parte* at 3.

[132] *6/23 GHz R&O* at ¶¶ 4-5.

[133] *See* Alcatel-Lucent Opposition at 7; Comsearch Comments at 6-9.

[134] 47 C.F.R. § 101.103(d)(1).

58. Finally, we seek comment on whether we should establish restrictions on the locations of auxiliary stations. One option would be to confine auxiliary stations to an area within a defined field strength level of the main link. Another option would be to provide that an auxiliary station could not generate field strength that exceeds the primary station's field strength beyond the perimeter where the primary station generates the field strength discussed above. We emphasize that compliance with such restrictions would not absolve auxiliary stations from the further requirement that they not cause incremental interference to other primary links. We invite comment on the appropriate metrics to use for defining the relevant field strength perimeters, as well as alternative means of establishing limitations on the locations of auxiliary stations.

V. NOTICE OF INQUIRY

59. This Notice of Inquiry is intended to generate a record about other potential changes to Part 101 rules that could potentially reduce wireless backhaul costs and increase investment in broadband deployment. In the first part, we ask about the possibility of relaxing efficiency standards in rural areas, where links may be longer and the density of deployment lower than in urban areas. In the second part, we inquire as to whether changes in the Part 101 rules to permit smaller antennas could similarly reduce costs and stimulate investment. We invite commenters to offer specific proposals for rule changes on these issues, and encourage a full discussion of the advantages and disadvantages of rule changes.

A. Modification of Efficiency Standards in Rural Areas

60. Under our current rules, rural providers must maintain the same capacity requirements also maintained by carriers in more densely populated metropolitan areas. Lower traffic volume on the rural networks and greater distances between microwave links may make maintenance of these minimum capacity requirements financially prohibitive in some instances. Lowering the current efficiency standards in rural areas could reduce the costs associated with wireless backhaul. We therefore seek additional comment on whether relaxing the current efficiency standards in rural areas would benefit rural licensees without diminishing the availability of already increasingly scarce backhaul spectrum.

61. Section 101.141(a)(3) of the Commission's Rules establishes minimum payload capacities (in terms of megabits per second) and minimum traffic loading payload (as a percentage of payload capacity) for various channel sizes in certain Part 101 bands.[135] The underlying purpose of the rule is to promote efficient frequency use.[136] The requirements set forth in the rule apply equally to stations in urban areas and to stations in rural areas. The Wireless Telecommunications Bureau has historically granted waivers to licensees in rural and remote areas where operation of microwave facilities at the required efficiency standards would cause financial hardship to the extent that the underlying purpose of the rule would be frustrated.[137] For instance, a system utilizing a modulation of 64 QAM would require a signal-to-noise ratio over 13 dB higher than a system utilizing 4 QAM or 4 QPSK. This means that by allowing less capacity in the rural areas, a licensee could either use less power or be able to slightly

[135] 47 C.F.R. §101.141(a)(3).

[136] *See* Reorganization and Revision if Parts 1, 2, 21 and 94 of the Rules to Establish a New Part 101 Governing Terrestrial Microwave Fixed Radio Service, *Report and Order*, WT Docket No. 94-148, 11 FCC Rcd 13449, 13476 ¶ 77 (1996).

[137] *See, e.g.*, Kentucky Power Company d/b/a American Electric Power, *Order*, 17 FCC Rcd 453, 455 ¶ 6 (WTB PSPWD 2002) (operation in remote area, and transmitter purchased before efficiency standards were adopted); Wilderness Valley Telephone Company, *Order*, 15 FCC Rcd 11751, 11752 ¶ 6 (WTB PSPWD 2000) (operation in remote area, and no model of compliant transmitter would withstand the weather conditions at the proposed site); Alcatel Network Systems, Inc., *Order*, 11 FCC Rcd 22407 (WTB PSPWD 1996).

lengthen its path.[138] We ask whether this waiver policy should be reflected in our rules so that applicants could obtain facilities for backhaul in rural areas without the cost and delay inherent in seeking a waiver of our rules.

62. To the extent commenters support lowering the efficiency standards in rural areas, we seek specific proposals to modify the efficiency standards in Section 101.141(a)(3) of the Commission's Rules. Proponents of changes in the standards should explain how changes would provide more flexibility and facilitate deployment of backhaul and other facilities in rural areas. Commenters should also address the impact such changes would have on existing licensees, including licensees in other services that share spectrum with FS. We ask whether any changes would be consistent with the underlying purpose of Section 101.141(a)(3), which is to promote efficient utilization of the spectrum.[139]

63. In connection with this inquiry, we seek comment on the definition of "rural" that might be used to determine which geographic areas would be defined as rural under a revised rule relaxing efficiency standards in rural areas. In the Commission's *2004 Report and Order* addressing the ways to facilitate and enhance the provision of spectrum-based service in rural areas the Commission provided a baseline definition of "rural areas" as, "those counties (or equivalent) with a population density of 100 persons per square mile or less, based upon the most recently available Census data."[140] The Commission first used this definition as a proxy definition in its annual CMRS Competition Report for purposes of analyzing the average number of mobile telephony competitors in rural versus non-rural counties.[141] At the time that the Commission adopted this definition, it was determined that such a specific definition was necessary to establish continuity so that the Commission would have a basis for comparison of the effects of its "rural area" policies over time.[142] It was determined in that same proceeding that the definition would be treated as a presumption to be applied for current and future Commission wireless radio service rules, policies and analyses for which the term "rural area" has not been expressly defined.[143] In light of this established presumption, we seek comment on whether this definition is suitable to determine areas which should be considered rural for purposes of microwave efficiency standards in this band. We also seek comment on potential alternative definitions and any supporting reasons for why a specific definition should be utilized.

B. Review of Part 101 Antenna Standards

64. In this section, we solicit proposals for allowing FS licensees to use smaller antennas. The National Broadband Plan noted that it was important to ensure that the Commission's antenna standards

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[138] *See* Source and Synthesizer Phase Noise Requirements for QAM Radio Applications by William Reuter, Senior Design Engineer, Synthesizer Group, CTI, Table 1, http://www.herley.com/pdfs/QAM_Article.pdf.

[139] *See* Reorganization and Revision of Parts 1, 2, 21, *and* 94 of the Rules to Establish a New Part 101 Governing Terrestrial Microwave Fixed Radio Services, *Report and Order*, WT Docket No. 94-148, 11 FCC Rcd 13449, 13476 ¶ 77 (1996); see also Wilderness Valley Telephone Company, *Order*, 15 FCC Rcd 11751, 11752 ¶ 5 (WTB PSPWD 2000).

[140] *See* In the Matter of Facilitating the Provision of Spectrum-Based Services to Rural Areas and Promoting Opportunities for Rural Telephone Companies To Provide Spectrum Based Services, *Report and Order*, WT Docket No. 02-381, *et al.*, 19 FCC Rcd 19078, 19087 ¶ 11 (2004) (*2004 Report and Order*).

[141] *See Id.*

[142] *See Id.* at 19086-19087 ¶ 10.

[143] *See Id.* at 19088 ¶ 12.

are up to date "in order to maximize the cost-effectiveness of microwave services."[144] Smaller antennas may be cheaper, easier to install, and generate fewer objections than antennas specified by the current requirements. We ask whether smaller antennas can be accommodated in any FS band without causing interference to other users in the band.

65. Section 101.115(b) of the Commission's Rules[145] establishes directional antenna standards designed to maximize the use of microwave spectrum while avoiding interference between operators.[146] More specifically, the Commission's Rules set forth certain requirements, specifications, and conditions pursuant to which FS stations may use antennas that comply with either the more stringent performance standard in Category A (also known as Standard A) or the less stringent performance standard in Category B (also known as Standard B).[147] In general, the Commission's Rules require a Category B user to upgrade if the antenna causes interference problems that would be resolved by the use of a Category A antenna.[148] The rule on its face does not mandate a specific size of antenna. Rather, it specifies certain technical parameters – maximum beamwidth, minimum antenna gain, and minimum radiation suppression – that, depending on the state of technology at any point in time, directly affect the size of a compliant antenna.[149] The Commission adopts antenna specifications based on the technical sophistication of the communications equipment and the needs of the various users of the band at the time.[150] Indeed, the Commission adopted similar technical specifications that effectively limited the size of antennas used in other bands,[151] including those used by certain types of satellites.[152] Periodically, the

[144] National Broadband Plan, Section 5.5, Recommendation 5.10 at 94.

[145] 47 C.F.R. § 101.115(b).

[146] *Id.*

[147] *See* 47 C.F.R. § 101.115(b)-(d).

[148] *See* 47 C.F.R. § 101.115(c).

[149] We may herein refer to those antennas that comply with the Category A standard as either compliant antennas or Category A antennas and those antennas that do not comply with the Category A standard as non-compliant antennas or Category B antennas.

[150] *See* Amendment of Part 101 of the Commission's Rules to Modify Antenna Requirements for the 10.7 – 11.7 GHz Band, WT Docket No. 07-54, *Report and Order*, 22 FCC Rcd 17153, 17156 ¶ 3 (2007) (*11 GHz R&O*); Reorganization and Revision of Parts 1, 2, 21, and 94 of the Rules to Establish a New Part 101 Governing Terrestrial Microwave Fixed Radio Services, *Report and Order*, WT Docket No. 94-148, 11 FCC Rcd 13449 (1996). The Commission declined to consider significant changes to the proposed rule at that time because commenting parties did not sufficiently address the issue in the record. *See id.* at 13474-13475 ¶¶ 67-71; *see also* Reorganization and Revision of Parts 1, 2, 21, and 94 of the Rules to Establish a New Part 101 Governing Terrestrial Microwave Fixed Radio Services, *Notice of Proposed Rule Making*, WT Docket No. 94-148, 10 FCC Rcd 2508, 2515 ¶ 19 (1994) (*Part 101 NPRM*).

[151] *See, e.g., 11 GHz R&O*, 22 FCC Rcd at 17156 ¶ 3; Reorganization and Revision of Parts 1, 2, 21, and 94 of the Rules to Establish a New Part 101 Governing Terrestrial Microwave Fixed Radio Services, *Memorandum Opinion and Order and Notice of Proposed Rulemaking*, WT Docket 94-148, 15 FCC Rcd 3129 (2000) (*Part 101 MO&O and NPRM*) (seeking comment on permitting smaller antennas in the 10 GHz band).

[152] *See, e.g.*, Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the KU-Band Frequency Range, ET Docket No. 98-206, *Second Memorandum Opinion and Order*, 18 FCC Rcd 10084 (2003).